Faecal Sterols and Aminopropanone as Chemical Markers for Sewage Pollution in Natural Waters

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Introduction

During the last decade there has been growing awareness of the adverse consequences of the discharge of untreated sewage into rivers, estuaries and coastal waters. A variety of methods have been used to monitor such pollution. The counting of faecal coliforms is the standard technique for the assessment of sewage contamination of waste water. However, doubts have been expressed about the reliability of this method (Santiago-Mercado et al. and Hanzen, 1987) and as a result, many attempts have been made to find chemical methods for monitoring sewage contimination. Some successes have been achieved using organic components of excreta as tracer for particulate sewage such as faecal sterol, coprostanol (Nichols et al., 1992). Uric acid and volatile alkylamines have been reported at extremely high concentrations in sewage (Brown et al., 1984, Scully et al., 1988). However, the short lifetime of the former, and the presence of latter within marine biota (Sorensen et al. and Glob, 1987; Abdul-Rashid, 1990), lead to problems with their use in the marine environment. Volatile aminoketone, 1-aminopropanone was recently reported to be a possible long lived dissolve sewage marker (Fitzsimons et al., 1995). The high concentration of aminopropanone associated with raw sewage derives mainly from direct excretion of it in urine.

Materials and Methods

Determination of aminopropanone: Aminoprpoanone was determined after pre-concentration by microdiffusion followed by packed column gas chromatography (GC) with nitrogen-phosphorus selective flame ionization (NP-FI) detection (Abdul-Rashid et al., 1991) Briefly, acidified water samples were placed in a series of Cavett diffusion flasks with HCl in the collecting-cups. The samples were adjusted to pH 14 with NaOH solution and the flasks were sealed immediately and were placed in a thermostatically controlled fan oven. After diffusion, the acid was quantitatively transferred into a graduated screw-cap glass vial; NaOH was added along with cyclobutylamine, which was used to measure the reproducibility of triplicate GC runs.

Determination of coprostanol: The unfiltered water samples were spiked with internal standard and were extracted by vigorous stirring with toluene – ethyl acetate (9:1). The non-aqueous fraction was then separated and dried over anhydrous sodium sulphate. The sodium sulphate was filtered off, washed with toluene-ethyl acetate (9:1; 2x) and the washing added to the organic fraction. The solvent was then removed by rotary evaporation under vacuum and the total extract was transferred to the top of a silica gel column. The column was developed with pentane, 25% toluene in pentane, 50% toluene in pentane, 5% ethyl acetate in pentane, 10% ethyl acetate in pentane, 15% ethyl acetate in pentane, and 20% ethyl acetate in pentane. The mixture was blown down under nitrogen and derivatized with bis-trimethylsilytrifluoroacetamide in pyridine. An aliquot of the derivatized sample was analysed by GC-FID. Coprostanol will be identify by comparison of it chromatographic behaviour with authentic standard.

Results and Discussion

At the moment the project is still at the final stage where most of the samples for coprostanol were already extracted and ready for GC analyses. The delay was mainly due to the technical problems with the instrumentation part, mainly the GC. The other main problem was in getting the authentic standard chemical. This project is still on going and hopefully the final results will be out by the end of this year.

Conclusions

This project is very important as an alternative to biological marker for sewage pollution especially in tropical condition.

Benefits from the study

The benefit of this study is that we can develop a fast detection method for sewage pollution using a few very stable compounds as chemical markers.

Literature cited in the text

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Project Publications in Refereed Journals

None.

Project Publications in Conference Proceedings

None.

Graduate Research

None.

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